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ABSTRACT

This study attempted to clarify the kind of correlations that can be found in the speech behavior of high-risk children in comparison with children without neonatal risk complications. The study concentrated on the articulatory ability of 430 five-year-old children with neonatal risk complications; it applied a cross-disciplinary diagnosis (child neurology, speech pathology, and psychology) to discover the extent to which certain risk factors influenced speech behavior, language, and psycholinguistic abilities. The results were compared with those of a control group of 115 children of corresponding ages, without any pregnancy, delivery, or neonatal risk. Analysis of the data revealed that there were two groups among the children with extremely slow neurodevelopmental maturation: children with severe articulation problems and a low linguistic performance level and children with phonological disorders and a normal linguistic level. Corresponding neurodevelopmental distinctions did not occur in the control group. This finding suggests that neonatal risk factors influence speech disabilities in the experimental group. (MSE)

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CLINICAL LOGOPEDICS: A DIAGNOSTICAL REVIEW OF SPEECH AND LANGUAGE DISORDERS IN A GROUP OF HIGH-RISK CHILDREN

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1. INTRODUCTION

It is evident that slow development of neural processing and neuro-musculator immaturity are factors in the disorders of children's speech and language development. The syndromes of the speech disorders of children are in close connection to the immature functioning of the central nervous system. Disorders can also be consequences of the delayed general development. Among the children of five years of age a wide spectrum of different delays in communication ability can be found. Most frequently this originates from the individual developmental processes in the earliest stages of life which are strongly influenced by the environmental circumstances. The early histories of some children show risk factors in the neonatal period. The influence of these early risk symptoms even as late as at the age of five has been shown in many studies (Calame & al., 1976; Dahlby, 1970; Ehrlich & al., 1973; Saarnivaara & al., 1976, Michelsson & al., 1981). It is common that the abundant existence of both articulation and language disorders at the age of five call for the clinical logopedic examinations. The careful anamnesis of etiological factors at the neonatal period facilitates speech diagnostics in clinical logopedics, as well as planning the amount and type of speech therapy. Language disorders form a very heterogenous group as to their etiology, non-linguistic symptoms and handicaps, their severity and linguistic characteristics (Nettelbladt, 1983).

Our objective here is to clarify what kind of correlations can be found in the speech behaviour of high-risk children in comparison with children without neonatal risk complications. For this purpose observations based on clinical logopedics are collected and on the basis of them the status of phonological development is compared to neurological maturity as one aspect, and psycholinguistic performance to the existence of phonological disorders as another aspect. In addition the mutual

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correlations of these aspects are assessed. We have particularly concentrated our work on the articulatory ability of the five-year-old risk children (N = 430), and we have applied a cross-disciplinary diagnosis (child neurology, speech pathology, psychology) in order to find out to what extent certain risk factors have influenced speech behavior, language and psycholinguistic abilities.

The results are compared with the results of the control group (N = 115) consisting of children of corresponding ages, who had not suffered of any risk factors during pregnancy, delivery or the neonatal period (Michelsson, 1981).

2. MATERIAL

The children in this sample were born at the Institute on Midwifery in Helsinki in 1971-1972 and in the newborn period they had one or more of the neonatal risk factors (Michelsson & al., 1981). When the children were five years of age the cross-disciplinary investigations were carried out at the Department of Pediatrics in the Helsinki University Hospital 1976-1977. Altogether 856 five-year-old risk children were examined by pediatric neurologists, speech therapists and psychologists during the years 1976-1979.

A control group was investigated with the same test methods at the age of five.

3. METHODS

Table 1. TEST METHODS OF THE TEAM (1976-1979)

- neurological screening (Bax & Whitmore)
- vision (Sheridan)
- hearing (audiometer)
- psycholinguistic test (ITPA) stadardized in Finland
- logopedical screening
- visual perception (Frostig)
- draw-a-person (Goodenough)
- parent's questionnaire
- teacher's questionnaire

The neurological examinations comprised the neurodevelopmental screening test for five-year-old children developed by Bax and Whitmore (1974). Its Finnish version KAM has been standardized by Michelsson, Ylinen, Donner (1982).

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Logopedical screening examinations were based on the methods of certain specific areas of clinical logopedics (Table 2).

Table 2. LOGOPEDICAL TESTS

- articulation test
- speech motor performance
- language behavior
- rhythmic coordination in visuomotor performance
- concentration ability
- observations of rhythm, voice and nasality
- ITPA, Illinois Test of Psycholinguistic Abilities (Finnish test version), auditive subtests

The phonological tests comprised an examination of sound-articulation separately and examinations of word articulation with a picture-vocabulary-test. The test included 46 simple nouns consisting of the most common sounds of the Finnish language, and their combinations in vowels and consonants.

Language behavior was assessed during the interview. Motor speech abilities were controlled by observing various movements of lips and tongue. The tonus and the coordination of the movements were assessed. The rhythmic coordination of hand and eye was assessed by pattern drawing, the appearance of tremor in the lines drawn and unrhythmical movement were observed. Observations were made of disorders in speech rhythm, voice and nasality. Concentration during the test was assessed. The twelve subtests of the psycholinguistic test ITPA were used, but divided between two test sessions so that the auditive subtests were performed by speech therapists and the visual subtests by psychologists.

Cross-disciplinary findings were discussed in a joint meeting, results were compared and the need for special examinations or rehabilitation was estimated and the appropriate measures were taken. Scoring in the logopedic screening tests has been described in detail in the papers of IALP Congress in Washington (Parre, 1980).

For this paper only two items of the total logopedical study are scrutinized and compared with the findings of neurodevelopmental investigations of Bax. Two of the tests will be taken under consideration; namely those which give results of logopedic-linguistic performance of the examined children (Table 2).

1. Articulation (phonological) level

   - sound errors were analysed as errors of phonetic and phonemic features; consonant errors were categorized into distortions, substitutions, omissions, and/or reversals; the vowel errors were counted as substitutions and inversions of the elements in diphthongs.

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For assessing the phonological level of the children's speech the analysis was based on the differences of phonetic or phonemic errors in consonants and vowels, their combinations and number of errors per child. The grades of severity were built up of the cumulative occurrence of errors, so that every clinically specific error got one point. (Table 3.)

Table 3. The grades and diagnostic level of articulation.

0 = faultless performance
1 = mild disorder
2 = moderate disorder
3 = severe disorder
4 = very severe disorder

The scale used for articulation skills ranged from 0 to 4.

2. Psycholinguistic level

- psycholinguistic performance was measured by ITPA's auditive subtests and according to ITPA's norms.

3. Neurodevelopmental level

The classification of Bax (Table 4) is divided in this study in three different categories; B1 = 12 (no neurological symptoms), B2 = 13 - 23 (slight to moderate symptoms), B3 = 24 (moderate to severe symptoms) (Saarnivaara & al., 1976). The mean Bax score for the control group was 9.0 (7.5 for girls and 10.2 for boys). The mean neurodevelopmental Bax scores for the risk group were 19.7 (17.7 for girls and 21.3 for boys) (Michelsson & al., 1981).

Table 4. Bax classification

Bax 1 = 12 scores
Bax 2 = 13 - 23 scores
Bax 3 = 24 scores

B1 - B2, Chi^2 29.14, df = 5, $p \leq .005$
B2 - B3, Chi^2 42.44, df = 5, $p \leq .005$

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4. RESULTS

The results have been gathered from the articulation test and psycholinguistic test and are compared with the results obtained from the neurodevelopmental screening test Bax.

As an analysis we present (in Tables 5 and 6) the comparisons and correlations between the findings of the tests of neurodevelopmental level, articulation skill and psycholinguistic abilities.

Table 5. Correlations between BAX scores and articulation.

Grades	Articulation level	Risk children B1 %	B2 %	B3 %	total %	Control group B1 %
0	no errors	73	46	23	48	74
1	one phonetic error	21	33	25	27	20
2	errors in two phonemes (consonants)	3	15	19	12	4
3	errors in different phonemes (vowels and consonants)	2	3	14	6	2
4	many errors in different phonemes, their combinations (at the level of syllable and word structure)	1	3	19	7	
		(140)	(159)	(131)	(430)	(115)

In Table 5 we can see the results of the correlation in the groups B1, B2 and B3 when articulation ability and neurodevelopmental delay are compared. The results show that the more neurological findings there are in children's performance the more disorders they have in articulation and phonological development. Differences

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between the performances of the whole group of risk children and the control children are also statistically significant ($p \leq .001$). The scores of group B3 (Table 5) also reveal that the children in this group have a great deal more disorders of grades 3 and 4 than the other children.

A very interesting point in results is the interrelation between the psycholinguistic profile and articulation disorder (grades 3 and 4) among the children who have low neurodevelopmental level B3, and articulation severity is diagnosed in the grades 3 and 4 (Table 6).

Table 6. Psycholinguistic profile and articulation disorders among risk children with neurodevelopmental level (B3)

ITPA Auditive subtests	B 3 No articulation disorders	B 3 Severe articulation disorders
M	34,5	27,9
D	(4,7)	(5,4)
N	30	25

$t = 5,81$, $df = 63$, $p \leq 0.001$

5. DISCUSSION

Our approach to this study has been based on the use of test batteries developed for clinical logopedics and neurodevelopmental screening Bax. The aim has been to prove that it is possible to ascertain the influences of the neonatal high-risk factors as retarding elements in development still at the age of five, as well as to clarify that behind slow neurodevelopmental maturity there can be found clusters of severe phonological disorders. The presence of these disorders also correlates with the slow development of the linguistic performance. Two diagnostically very interesting groups appear in Table 6 among the children whose general neurodevelopmental maturation is extremely slow, B3 (N = 55). One group (N = 25) consists of children who have severe articulation problems (grades 3 and 4) and a low linguistic level according to ITPA. The other group (N = 30) consists of children who have no

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phonological disorders and their performance level according to ITPA is normal. It means that, as a whole, their syntactic and semantic capability is normal, but the neurodevelopmental maturity of the children is low.

In both cases there are factors based on neurodevelopmental delay; one group consists of children who have developmental language disorder and the other of children with certain psychomotorical delay. Among the control children there does not exist a group corresponding to the one in Table 6. The difficulties in the development of the children are inevitably symptoms of neonatal risk-factors.

It is not easy to define specifically what kind of neurodevelopmental syndromes or language/linguistic disorders exist in each case. Within each speciality and discipline there are many classifications to solve the problem of speech and language behaviour. Many studies have been made to classify developmental language disorders according to linguistic, neurological, psychological, logopedic etc. criteria (Crystal 1980, Ingram 1972, Nettelbladt 1983) and, yet according to Michelsson (1981), the extent to which neonatal disturbances have an influence later in life is not fully known.

Our objective has been firstly to study certain speech and language problems among high-risk children with the screening methods of clinical logopedics and compare the results with the findings of neuropediatrics; secondly to prove that the tests used in screening are valid for cross-disciplinary diagnostics when solving the specific problems and diagnostics in the cases of each children. We have in a way come close to a methodological approach in severe dysphonology and have also applied part of the theory in accordance with Nettelbladt (1983). Although our methods are based more on the clinical logopedics than clinical linguistics we have also found out, as did Nettelbladt (1983), that the focus is too limited for proper understanding of the special features in severe language and articulation problems.

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